

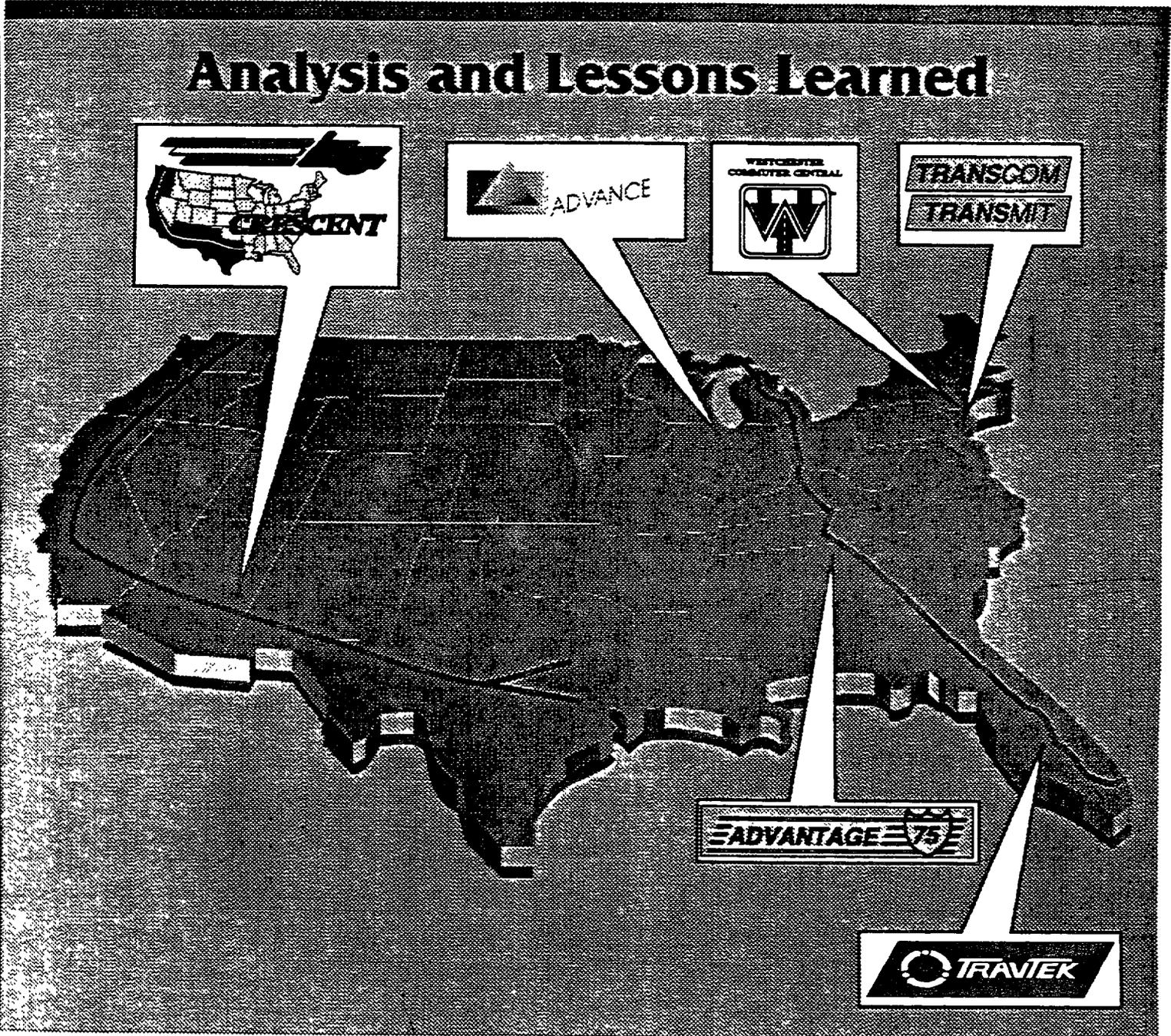


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# IVHS Institutional Issues and Case Studies

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*Final Report*

IVHS Institutional Issues and Case Studies

Analysis and Lessons Learned

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# Preface

This "Analysis and Lessons Learned" report contains observations, conclusions, and recommendations based on the performance of six case studies of Intelligent Vehicle-Highway Systems (IVHS) projects. It is the final report of work led by Science Applications International Corporation (SAIC) in response to a Volpe National Transportation Systems Center technical task directive (TTD) entitled, "IVHS Institutional Issues and Case Studies." Of the six projects, SAIC conducted interviews and wrote case studies of the ADVANCE, HELP/Crescent, TRANSCOM/TRANSMIT and Westchester Commuter Central projects. Cambridge Systematics, Incorporated (CSI), SAIC's primary subcontractor for this TTD, assisted with interviews of ADVANCE personnel and independently conducted interviews and case studies for the Advantage I-75 and TRAVTEK projects.

Information to support the development of the case studies included available documents on each program as well as interview notes and summaries based on an interview protocol especially created for this contract. A detailed description of the standardized procedures and methods followed during the conduct of the interviews is documented within a "Detailed Field Guide," produced as a separate deliverable of this TTD. Also, a separate "Case Study" has been published on each of the six projects. Lists of agencies interviewed and bibliographies of key references are provided as appendices to each case study.

This report, based on an analysis of the six case studies, indicates the identification of institutional issues encountered, lessons learned, and for improving the performance of other operational field tests and deployments of IVHS products and services. Unlike case studies where projects have been completed and positive and negative lessons were learned after the total success of the system could be assessed, the case studies for this report were performed on projects that were in various stages of development and none of which had been fully deployed. Therefore, interviews represented a snapshot in time during the progress of the projects, and issues identified at the time of the interviews may only be temporary. In some instances, interviews precipitated the first realization that something was an issue and the subsequent beginning of remedial actions. For those projects in later stages, issues that might have been significant in earlier phases might have been forgotten, especially if they were successfully resolved. Therefore, more weight was given to issues that were identified as existing in the current phase of the respective project, or for which there was concurrence across individual accounts.

Interviews for the case studies were performed during the summer of 1993; this report endeavors to provide a balanced presentation of the issues as portrayed by those interviewed. An attempt was made to use corroborating stories as evidence of the accuracy and/or significance of issues raised. However, as with any report heavily dependent upon interviews, the accuracy and completeness is only as good as the accuracy and completeness of personal accounts told to and recorded by the interviewers. To help ensure accuracy and a balanced view of the issues, each program manager received a draft of the case study report for his project and was given the opportunity to comment. Nevertheless, the authors take sole responsibility for the accounts portrayed in the case study reports.

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As with any case study or lessons learned report, authors are subject to criticism that their evaluations either seek out the negative aspects with little emphasis on positive lessons, or are incorrect, biased, or lay blame. It is with great sensitivity to these issues that the case study reports and this report were written. Postured to identify issues, the authors acknowledge the fact that interviews were oriented toward finding problems; however, an attempt to identify positive lessons was also made, and the results are reported. The intent of the authors was to avoid inaccuracies, bias, or blame, and to provide helpful hints to others who are about to embark on similar initiatives.

## **Acknowledgements**

Of special note is the expert consultation and review provided to this effort by a specially formed, "Institutional Barriers Advisory Group." This group, chaired by Mr. John Mason of SAIC, also included Dr. Christopher J. Hill of Castle Rock Consultants, Mr. Lance Grenzeback of Cambridge Systematics, and Mr. Kenneth Oeski of Urban Mobility Corporation. The contributions of this group added greatly to the insight of the interviews and writers.

The authors would gratefully like to acknowledge the assistance rendered by the six operational field test program managers and their public and private sector partners. Also, special thanks go to all of those who participated in the interview process and contributed such thoughtful insights that can be valued by others facing similar tasks. Finally, many thanks go to Mr. Allan DeBlasio from the Volpe Center for his guidance, understanding, and support.

# Summary

The U.S. Department of Transportation developed the 1992 Intelligent Vehicle Highway Systems (IVHS) Institutional Issues (Non-technical Constraints) Program in response to the Intermodal Surface Transportation Efficiency Act's emphasis upon meeting both the technical and non-technical challenges toward achieving IVHS goals. This report culminates the performance of six case studies with the primary purpose of answering four questions:

1. What institutional and legal impediments were encountered establishing partnerships and deploying IVHS services and products during operational tests?
2. Where in the life cycle of the operational tests did these impediments occur?
3. How were these impediments overcome?
4. What lessons were learned in dealing with these impediments that can be applied to future deployments of IVHS products and services?

Institutional issues-related case studies were performed on these six IVHS projects:

1. ADVANCE
2. Advantage I-75
3. HELP/Crescent
4. TRANSCOM/TRANSMIT
5. TRAVTEK
6. Westchester County Commuter Central.

These projects and their status are presented according to the analysis framework shown in the following table. It includes the phase of each project at the time that respective project personnel were interviewed in the summer of 1993, and also shows the type of system that each project either has or is developing, i.e. advanced traveler information system (ATIS), commercial vehicle operations (CVO), or advanced traffic management system (ATMS). The projects' life cycle phases and types of systems represented were areas where the analysis of institutional issues endeavored to identify trends.

### Phase of Projects At the Time of Interviews

IVHS PROJECTS	PROJECT PHASES				
	OPERATIONAL FIELD TEST				DEPLOYMENT
	Plan	Design/ Develop	Implement/ Test	Evaluate	
ATIS					
ADVANCE					
TRAVTEK					
WCC					
CVO					
Advantage I-75					
HELP/ Crescent					
ATMS					
TRANSCOM/ TRANSMIT					

= Phase of Project During Interviews

### Institutional Issues

Four major categories of institutional issues are identified:

1. Organization and Management.
2. Regulatory and Legal.
3. Human and Facilities Resources.
4. Financial.

A summary of the issues and mitigation strategies follows:

## Category #1: Organization and Management Issues

*Of the four categories of institutional issues defined, this contained the largest number of institutional issues. The following are the issue types identified and discussed under this category:*

- Cultural Differences in Public-Private Partnerships

**Issue:** A fundamental impediment to the smooth accomplishment of a partnership agreement for many of the projects was the stark difference in the ways the partners, particularly between those in the private sector versus those in the public sector, did business.

**Strategy:** Communication and patience instilled by strong and determined leadership was the strategy that worked best.

- Lack of Inter-Partner Communications

**Issue:** The following factors contributed to this problem:

- Negative stereotypes of cultural differences
- Lack of Trust
- Unclear/changing definition of goals, roles and responsibilities
- Imprecise definition of “evaluation”
- Lack of communication protocols

**Strategy:** Recommended holding a 5 to 7 day retreat at the beginning of the project for the purposes of team building and developing the essential elements of a joint partnership agreement.

- Lack of Intra-Partner Communications

**Issue:** Communications problems are greatest in the CVO arena whereby a single state representative is required to represent multiple state agencies.

**Strategy:** Encourage either partnership at the state agency level or obtain top level management endorsement of a lead agency and full support by other participating agencies.

- **Management Challenges**

**Issue:** The following are some of the factors that contributed to the problem:

- Evaluation planning problems
- Over dependence on unproven technology
- Contract and contractor problems
- Aggressive project schedule
- Size of policy committee

**Strategy:** The program manager is key. The strength of the program manager was often the single reason an issue was overcome.

## Category #2: Regulatory and Legal Issues

*Of the four major categories of issue types, this category contains issue types that had obvious, near and far term implications for the IVHS products and services proposed for testing. Regulatory and legal issue types found to be of more immediate concern to partners of operational field tests were those in the critical path of beginning the Implementation/Test and Evaluation Phases. These issues included:*

- Unclear Government Accounting Requirements

**Issue:** Work performed with Federal funding requires the accounting of direct, overhead, and fee expenses incurred by private sector vendors. The private partner insisted on total confidentiality regarding product costs.

**Strategy:** While the issue was not resolved at the time of the interviews, it appears that a third party auditor will be the agreed upon solution.

- Burdensome Administrative Requirements

**Issue:** The issue of how to administer funding from multiple sources was a significant hindrance to the progress of every IVHS operational test.

**Strategy:** Recommend an end-to-end review of existing IVHS administrative processes and procedures.

- Concerns Regarding Liability and Insurance

**Issue:** Who will insure vehicles for collision and liability and for such things as wrong way directions, etc.?

**Strategy:** Multiple recommendations to include: design for safety, partners self-insure, participants sign an agreement that spells out the risks, and screening for safe drivers.

- Concerns Over Legality of New Technologies in Moving Vehicles

**Issue:** How much and what types of information should a driver be allowed to receive without causing a safety hazard due to divided attention taking the driver's eyes off of the road? The issue of multifunction displays in automobiles and the functions that are allowable during driving (e.g., moving map displays and reception of television entertainment programs), will be a growing issue nationwide.

**Strategy:** Obtain legal ruling as soon as possible while performing public outreach to legislatures to sensitize them to the issue.

. Concerns Regarding Intellectual Property and Property Rights

**Issue:** This issue stems from the stereotypical view that the results of any endeavor that uses Federal funding will fall in the public domain.

**Strategy:** Provide for assignment of intellectual property rights in the partnership agreement.

*One CVO issue that is in the critical path of current and future CVO operational field tests has to do with:*

. Concern Over Differing State Regulation Governing CVO Operations

**Issue:** Partnering states had difficulty reaching agreement on an acceptable regulatory and enforcement protocol for cvo. Differences in scale tolerances, weight limits, and acceptable evidence of truck safety inspections contributed to the problem

**Strategy:** Negotiate and compromise with participating states, with top-level state management pressuring participants to effect solutions.

*Those issues with more obvious implications that go beyond operational field testing of IVHS products and services and extend into scenarios for their commercial or operational deployment include:*

. Lack of IVHS Technology Standards

**Issue:** The lack of technical standards has the potential to become the biggest institutional impediment to the successful commercial deployment of the majority of IVHS projects. Benefits associated with helping to develop standards could have a devastating business consequence to a company that invests in the "wrong" technology.

**Strategy:** Design and implement a national architecture.

. Concern Regarding Potential Negative Public Reaction

**Issue:** Concerns regarding public reaction to potential redistribution of congestion-causing traffic to local arterial.

**Strategy:** ~~Ensure close contact with affected municipalities.~~

**Issue:** ~~Concerns regarding public perceptions that IVHS technologies can compromise individual privacy.~~

**Strategy:** ~~Develop and implement a public education program concerning what IVHS can do and can not do.~~

**Issue:** Concerns regarding a lack of data on environmental impacts.

**Strategy:** Provide for environmental assessments in evaluation plans.

### Category #3: Human and Facilities Resources Issues

*This category focuses primarily upon people-related issues in response to two simple questions: (1) Do you have enough people?, and (2) Are the people qualified to do the work?*

- **Quality and Sufficiency of Partner Leadership**

**Issue:** Two issues were identified in this area: (1) criticality of the program manager role, and (2) lack of partner leadership, authority and continuity.

**Strategy:** Select a program manager who will make a full-time commitment to the position from project start through deployment and is good at communication and collaboration.

- **Quality and Sufficiency of Support Resources**

**Issue:** Lack of quality and sufficiency of Federal/state DOT staff resources.

**Strategy:** Resolve through the combination of new hires, retaining and external support.

**Issue:** Lack of quality and sufficiency of program staff resources.

**Strategy:** Recommend a small staff with multiple diverse skills augmented by contractor support.

**Issue:** Lack of quality and sufficiency of contractor support resources.

**Strategy:** Bring integration and evaluation contractors on-board early to ensure resource flexibility.

### Category #4: Financial and Market Uncertainty Issues

*Of the four categories of institutional issues, this category contains issues which present the greatest diversity in definition as well as risk to deployment of IVHS products and services. The following issues are discussed under this category.*

- **Cost Sharing Goals and How They Will be Measured**

**Issue:** How the non-Federal partners apportion the expenses of an operational test is left to the ingenuity of individual partnerships.

**Strategy:** Preferred approach for one ATIS project was to link partners' cost share to project activities or functions that must be performed, while for a second ATIS project, the approach was to use an independent party to assess dollar value of contributions. The preferred method for CVO projects is to pro-rate cost share as a function of benefits accrued.

- Projecting Project Funding Through Deployment

**Issue:** Program cost and uncertainty about continued Federal support of IVHS programs was seen as a significant impediment to deployment. There is a concern that the Federal Highway Administration (FHWA), after providing funding to initiate the test, will require the states to absorb all future maintenance costs of elements critical to the program.

**Strategy:** Various options are under consideration which range from state/local governments selling information to privatizing the system by turning it over to the traffic service media.

- Market Uncertainty and User Willingness to Pay

**Issue:** The uncertainty issue is driven by two factors: (1) A realization that IVHS products and services will be expensive, and (2) Lack of information on the value of products and services from the perspective of the market place.

**Strategy:** Develop and implement a national public outreach program.

## **Lessons Learned**

There were numerous lessons learned by the operational test participants:

### **Public/Private Partnerships Require Building Trust, Understanding, Commitment, and Communication**

When any of these ingredients are missing, problems will arise; when all of them are compromised, severe difficulties are inevitable. When trust is missing, achieving consensus on project direction and resolving technical issues becomes very difficult. Trust is built by working together toward common objectives and seeing team members live up to their commitments. Understanding of roles and responsibilities and commitment to mutual goals keeps the project moving toward deployment.

### **Partners' Roles and Responsibilities Need to be Clearly Defined Early in the Planning Stage**

Without a clear understanding of the roles and responsibilities of each partner, project cost and schedule will suffer. A lack of consensus on project goals resulted in project partners pulling in different directions, thereby making consensus on technical issues difficult to achieve. A joint agreement that spells out clearly each partners roles and responsibilities should be developed and signed by all partners early in the project's planning stage.

## **Good Leadership and Full-time Commitment is Essential**

The project suffers when the original champions of the project could not step up to a full-time commitment. For any complex project, such as an IVHS operational test, good leadership must be full-time from the start. Leaders of operational tests spoke with a single voice - *the program manager is key*. Although personality is a subjective trait, it became clear that not having the right person for the job could ultimately halt the program. Respected characteristics of a leader include integrity having an open mind and even temperament, decisiveness, and assertiveness to keep the project on track. Such personality traits overcome the concerns that such a person might bring biases from the donating partner's organization.

## **System Integrator and Evaluation Contractors Should be Brought On-board Early**

Get all of the projected contractors on board at the beginning of a project to reduce start-up time and expand the pool of resources available to support the partners. Having both the systems integrator and evaluation contractors working as part of the project team supports team building and ensures the necessary expertise needed to plan the operational test activities through evaluation and into deployment.

## **The Evaluation Process Should be Initiated During the Project Planning Phase**

Planning for the project evaluation should be an intrinsic and early component of the project. Evaluation needs should be identified at the beginning of a project to ensure that sufficient resources are allocated by the appropriate partners and that the operational test enables the collection of the types of data necessary for the evaluation. Structure the planning process so that the distinctions between technical equipment testing, operational field testing and evaluation of the operational field test are clear. Follow-through with evaluation activities in each phase of the operational field test.

## **Complex Projects Require Flexibility by All Parties**

It is important to accept at the outset of a complex project, such as an IVHS operational field test, that many unanticipated problems will arise during the course of the project. Project start-up, in particular, tends to be more complex, time consuming and resource demanding than originally planned. Rigid adherence to project requirements, both in contracts and in less formal agreements, is unlikely to be the best course in such a project. Building in some periodic reviews of the work statement in the systems integration contract, for example, might have prevented some of the problems that arose with one of the project's fixed price systems integration contracts.

## **Contracting Flexibility is Important**

Unanticipated changes to the contracting schedule or contract scope of work should be expected, and a process set up to handle the changes. When contracts had to be modified to include support for the operational testm the process was too cumbersome to respond quickly to the need to provide day-to-day operational test management support.

## **IVHS Operational Tests Need a Buy-in at Two Management Levels: Upper- and Mid-Level**

Upper management support is necessary in order to quickly intercede to resolve bureaucratic roadblocks or personnel issues. In one of the projects, a state budget staff person decided that there were severe budget and environmental impediments to the state's participation in the IVHS project. Through high level state support, this person was replaced by other people who felt that the project was a priority. In another project, success required the support of not only the state Transportation Commissioner, the Treasurer, Controller, Attorney General, but also their mid-level staffs.

## **Inter-Agency Cooperation is Facilitated by Having an Advocate in Every Key Agency**

Inter-agency cooperation is facilitated when key participants enjoy a professional relationship and share common IVHS goals that transcend the near-term objectives of the operational field test. One project found that the mere existence of their regional cooperative forum fostered cooperation among the participants involved in its IVHS project. This cooperative spirit has enabled this group to work through and solve a number of serious early planning problems that potentially could have shut down the IVHS project.

## **Demonstrable Benefits are Critical to Participants and Participation by All is Critical to Success**

Operational tests must have a high probability of generating real benefits; those benefits must be clearly communicated to prospective participants if they are expected to contribute resources as well as their reputation to the effort.. For example, the process of educating the participants on the prospective benefits does not end with the project kick-off. This continuing education process is necessary to recruit the commitment of representatives who have the clout to keep the project moving forward, and who are able to balance their individual organizational concerns with the project's overall goals.

## It is Important to Make Progress

Complex, public-private IVHS partnerships have a limited window of opportunity for performance and many potential obstacles to completion such as changes in state administrations, project personnel, and the national economy. Therefore, efficiently moving the project on a fast track and doing everything possible to keep near to schedule is important. Keeping the project moving requires strong leadership; it also requires having the right people making decisions and establishing an efficient decision-making process.

## Findings and Recommendations

Each recommendation is paired with a finding. The recommendation is first stated, followed by the finding and then an expansion on the recommendation.

### **Recommendation #1: Develop an Information Packet to Facilitate Project Start-up**

**Finding:** Start-up processes are unnecessarily problem prone.

**Recommendation:** Develop an information packet for new partnerships to help them get organized and to guide them through project start-up activities. At a minimum, the scope of the packet should include the following

- 1) Checklist on what needs to be done to enter into a partnership with the U.S. Department of Transportation.
- 2) Glossary of administrative terms and acronyms (e.g. FAR, work order).
- 3) Roles and responsibilities of the partners and the various FHWA offices (i.e. headquarters, region, division).
- 4) Summary of the various administrative requirements and those compliance actions required by the partner's program manager (e.g., federal funding sub contracting **environmental** impact).
- 5) **Listing of lessons learned based on a survey of all on-going IVHS operational tests.**

**At a maximum, consider using the packet as a syllabus for a first-day training session in a 5 to 7 day retreat of the partners. During project start-up, this retreat would contribute to team**

building, as well as provide the partners with the opportunity to concentrate on working out the details of a joint partnership agreement.

**Recommendation #2: Promote the Selection of a Program Manager who Will Make a Full-time Commitment and is Good at Communication and Collaboration**

**Finding:** The program manager is key.

**Recommendation:** Promote the selection of a program manager who will make a full-time commitment to the position from project start through deployment. The successful program manager is good at communication and collaboration, detail-oriented, and totally dedicated to the job. Additionally, the PM must be a good public relations person with the ability to work with senior and middle management. Even with godfathers and executive champions in place, the timely success of a program ultimately rests upon the program manager who has to overcome many of the negative institutional forces that exert themselves on these programs daily.

**Recommendation #3: Provide CVO Public/Private Partnerships special Assistance as Required**

**Finding:** Institutional issues impose a greater barrier to the deployment of CVO systems than to advanced traveller information systems or to advanced traffic management systems.

**Recommendation:** CVO IVHS projects are particularly susceptible to institutional problems because of the sheer number of organizations with divergent interests that are involved in the project. In the view of the study team, there is no clear remedy to the problem other than to provide the assistance requested and the time required to work out the problems which will most mainly arise.

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**Recommendation #4: Expand and Institutionalize Evaluation Guidelines and Requirements**

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**Finding:** Evaluation requirements and terms are not well defined and understood.

**Recommendation:** Expand the scope of the existing evaluation guideline (draft), finalize it, and make it policy. Current Department of Transportation evaluation guidance is contained in two source documents: (1) DOT Federal Register announcement, dated 8 September 1993, that requested partnership proposals for new operational tests and (2) MITRE working paper, dated October 1993, titled: Generic Operational Test Evaluation Guidelines. The MITRE working paper provides useful guidance with specific application to IVHS advanced traveler information systems (ATIS) and advanced traffic management systems (ATMS) but not specifically to all IVHS subsystems including commercial vehicle operations (CVO), advanced vehicle control systems (AVCS), and advanced public transportation systems (APTS).

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**Recommendation #5: Develop and Implement an IVHS Deployment Strategy**

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**Finding:** Insufficient attention is being given to the critical issues associated with deployment.

**Recommendation:** Priority should be given to developing and implementing a national IVHS deployment strategy. The National Program Plan for IVHS (Draft October 15, 1993, FHWA-SA-94-024) addresses deployment but the draft plan currently lacks implementation details. For example while the plan envisions a public outreach program, it does not establish roles and responsibilities for the collection and dissemination of information in support of a public outreach program.

There is a need to define, understand, and quantify the potential benefits of IVHS to the general public. Some operational tests provide better opportunities to collect IVHS benefits data than others. A master plan should be used as a roadmap to guide an IVHS benefits assessment effort. Requirements should be identified early in a test's life cycle so that they can be included in the evaluation plan. Cost is another consideration. Since evaluation activities are expensive, a master plan will also eliminate unnecessary duplication of effort.

Public outreach programs are needed at three levels: national, regional/state, and local. The focus of the national level should be to increase public awareness and gain support of IVHS products and services as a national priority, while regional and state programs should link on-going and